CLAIMS

1. A fuel reformer, comprising:

a high-temperature unit having a combustion chamber in which fuel is burned, and a reforming section disposed on an outer peripheral surface side of the combustion chamber and filled with a reforming catalyst in an annular shape;

a medium-low-temperature unit having a shift converter section located on a side where the medium-low-temperature unit is connected to the high-temperature unit and filled with a shift converter catalyst in a cylindrical or annular shape, and a selective oxidation section located on a side opposite the side where the medium-low-temperature unit is connected to the high-temperature unit and filled with a selective oxidation catalyst in a cylindrical or annular shape;

a connection flow pipe for supplying reformate having passed through the reforming section of the high-temperature unit to the shift converter section side in the medium-low-temperature unit; and

a vessel for integrally housing the high-temperature unit and the medium-low-temperature unit connected by the connection flow pipe.

2. The fuel reformer of Claim 1, further comprising:

a reforming additive water passage formed in a gap between outer walls of the high-temperature unit and the medium-low-temperature unit and an inner wall of the vessel; and

a reforming additive water injection port provided at an end of the reforming additive water passage on a side opposite the side where the medium-low-temperature unit is connected to the

high-temperature unit.

3. The fuel reformer of Claim 2, further comprising:

a reforming material supply passage for supplying reforming material to the high-temperature unit; and

a mixing chamber communicating the reforming additive water passage and the reforming material supply passage.

4. The fuel reformer of Claim 2, further comprising:

a reforming material supply passage for supplying reforming material to the high-temperature unit;

a second reforming additive water passage for supplying reforming additive water directly to the high-temperature unit, not through the medium-low-temperature unit; and

a mixing chamber communicating the reforming additive water passage, the reforming material supply passage and the second reforming additive water passage.

5. The fuel reformer of any one of Claims 2 to 4, further comprising:

a baffle plate provided in a gap at a joint between the high-temperature unit and the medium-low-temperature unit; and

a heat exchanging section provided between opposite faces of the high-temperature unit and the medium-low-temperature unit for exchanging heat between reformate flowing from the high-temperature unit to the medium-low-temperature unit and the reforming additive water.

6. The fuel reformer of any one of Claims 1 to 5, wherein the connection flow pipe has an expandable member expandable and

contractible in the axial direction of the connection flow pipe.

7. The fuel reformer of any one of Claims 1 to 6, wherein the shift converter section has a first shift converter section located on a side of the high-temperature unit and filled with a first shift converter catalyst in a cylindrical or annular shape, and a second shift converter section located on a side of the selective oxidation section and filled with a second shift converter catalyst in a cylindrical or annular shape.

8. The fuel reformer of Claim 7,

wherein the second shift converter section has: an inner cylinder disposed coaxially with an outer wall of the medium-low-temperature unit; and an intermediate cylinder disposed coaxially with an outer wall of the medium-low-temperature unit and on the outer peripheral side of the inner cylinder, and

wherein a gas introduction passage for the reformate having passed through the first shift converter section is defined by an inner peripheral surface of the inner cylinder, a catalyst filled-layer of the second shift converter section is defined by an outer peripheral surface of the inner cylinder and an inner peripheral surface of the intermediate cylinder, and a gas discharge passage is defined by an outer peripheral surface of the intermediate cylinder and an inner peripheral surface of the medium-low-temperature unit.

9. The fuel reformer of Claim 8,

wherein the second shift converter section also has: a first opening communicating the gas introduction passage and the

catalyst filled-layer of the second shift converter section, and disposed at the inner cylinder on the side of the selective oxidation section; and a second opening communicating the catalyst filled-layer of the second shift converter section and the gas discharge passage, and disposed at the intermediate cylinder on the side of the first shift converter section.

10. The fuel reformer of any one of Claims 1 to 9, comprising a baffle plate in a gap between the shift converter section and the selective oxidation section, wherein a selective oxidation air introduction port is located in an opening at a center of the baffle plate.

11. The fuel reformer of any one of Claims 1 to 10, wherein the selective oxidation section has a cylindrical hollow section through which the reformate flowing from the shift converter section cannot pass in a vicinity of a center thereof.

12. The fuel reformer of any one of Claims 1 to 6, wherein the medium-low-temperature unit has a shift converter section having a first shift converter section located on a side of the high-temperature unit and filled with a first shift converter catalyst in a cylindrical or annular shape and a second shift converter section filled with a second shift converter catalyst in a cylindrical or annular shape and disposed coaxially with the selective oxidation section.

13. The fuel reformer of Claim 12, wherein the second shift converter section has: an inner cylinder disposed coaxially with an outer wall of the medium-low-temperature unit; and an

intermediate cylinder disposed coaxially with the outer wall of the medium-low-temperature unit and on the outer peripheral side of the inner cylinder, and

wherein there are further provided: a catalyst-filled layer of the second shift converter section provided in a space defined by an outer peripheral surface of the inner cylinder and an inner peripheral surface of the intermediate cylinder; a selective oxidation catalyst-filled layer of the selective oxidation section in a space defined by an outer peripheral surface of the intermediate cylinder and an inner peripheral surface of the medium-low-temperature unit; a gas introduction passage formed between opposite faces of the first shift converter section and the second shift converter section for feeding the reformate having passed through the first shift converter section to the second shift converter section; and a gas discharge passage for the reformate having passed through the second shift converter section communicating the bottom side of the second shift converter section and a part of the selective oxidation section facing the first shift converter section.

14. The fuel reformer of Claim 13, further comprising

a baffle plate disposed between opposite faces of the first shift converter section and the second shift converter section,

wherein the gas introduction passage is defined by the baffle plate, an inner peripheral surface of the intermediate cylinder, and an outer peripheral surface of the inner cylinder.

15. The fuel reformer of Claim 13, wherein the gas discharge passage is defined by a bottom of the intermediate cylinder,

an inner peripheral surface of the inner cylinder, and a conduit connecting the inner peripheral surface of the inner cylinder and the selective oxidation section.

16. The fuel reformer of any one of Claims 1 to 15, further comprising a vacuum heat insulating layer provided on an outer periphery of the vessel.

17. A fuel reformer, comprising:

a high-temperature unit having a combustion chamber in which fuel is burned, and a reforming section disposed on the outer peripheral side of the combustion chamber and filled with a reforming catalyst;

a medium-low-temperature unit having a shift converter section for shift-converting reformate having passed through the reforming section of the high-temperature unit, and a selective oxidation section for performing selective oxidation of the reformate shift-converted in the shift converter section;

a reforming additive water passage which is disposed in such a manner that reforming additive water can undergo heat exchange in the medium-low-temperature unit and which can supply the reforming additive water to the high-temperature unit;

a second reforming additive water passage for supplying reforming additive water directly to the high-temperature unit, not through the medium-low-temperature unit;

a reforming material supply passage for supplying reforming material to the high-temperature unit; and

a mixing chamber communicating the reforming additive water passage, the second reforming additive water passage and the

reforming material supply passage.